

side with the fawn-colour. The sides of the head and under-plumage are uniform, except on the sides of the breast and across the neck, where there are small black triangular spots in the centre of some of the feathers. The under wing-coverts are pure pale buff; the middle of the belly and crissum lighter and nearly whitish.

4. *OTOCORYS PEREGRINA.*

Otocoris chrysolaimos, Bp. Att. Sc. It. 1845, p. 405 (nec Wagl.).

O. supra grisescenti-brunnea, rufo tincta; pennis nigro variegatis: fronte, facie gulaque flavis, loris et regione auriculari et vitta transversa verticis cum plaga magna superpectoralis nigris: abdomine crissoque et tectricibus alarum inferioribus albis, pectore et lateribus rufescenti-griseo mixtis: alis nigricantibus; primariis albido, secundariis rufescenti-griseo, tectricibus majoribus rufo limbatis; tectricibus summis pure rufo-brunneis, pæne castaneis: cauda nigricante; rectrice una utrinque extima late, secunda autem versus apicem solum et angustius albo limbata; duabus mediis rufescenti-griseo utrinque late marginatis: tectricibus caudæ superioribus basi rufis: rostro nigro, mandibula inferiore basi alba: pedibus intense brunneis.

Long. tota 5.5, alæ 3.8, caudæ 2.4.

I have had an example of this bird in my possession several years, but have always considered it the same as Wagler's *O. chrysolæma*, with which it has been identified by Prince Charles Bonaparte. Having however lately obtained specimens of the Mexican species, I find the Bogota bird presents such differences as to render its specific isolation necessary. It is rather smaller than the former, the tail is shorter, the bill longer and more curved, and the back has more black upon it. But the chief peculiarity to be remarked in my specimen (which is not quite adult) is the pure red-brown colour of the upper wing-coverts, which in the Mexican bird are lighter, paler, and more pinky. There are many examples of this species in the Paris Museum, in the collection recently transmitted from Bogota by M. Lewy, the French consul there. I have no doubt fully mature individuals will exhibit still further differences.

ROYAL INSTITUTION OF GREAT BRITAIN.

May 2, 1856.—The Duke of Northumberland, K.G., F.R.S.,
President, in the Chair.

“On the Ruminant Quadrupeds and the Aboriginal Cattle of Britain.” By Prof. Owen, F.R.S.

The speaker introduced the subject of the Ruminant order of quadrupeds, and the source of our domesticated species, by some general remarks upon the classification of the class *Mammalia*, and on the characters of the great natural group defined by Ray and Linnæus as the *Ungulata*, or hoofed mammalia.

These are divisible into two natural and parallel orders, having respectively the *Anoplotherium* and *Palæotherium* as their types; which genera, as far as geological researches have yet extended, were the first, or amongst the earliest, representatives of the *Ungulata* on this planet.

The brilliant researches of Baron Cuvier, the founder of palæontological science and the reconstructor of those primæval hoofed animals, from fragmentary fossil remains in the gypsum quarries at Montmartre, were alluded to.

Diagrams of the entire skeletons of the Anoplotherium and Palæotherium were referred to, in illustration of their dental and osteological peculiarities.

The *Anoplotherium*, with the typical dentition of

3—3	1—1	4—4	3—3	= 44,
incisors	canines	premolars	molars	
3—3	1—1	4—4	3—3	

had all its teeth of the same length, and in a continuous unbroken series: this character is peculiar to Man in the existing creation. The *Palæotherium*, with the same dental formula as the *Anoplotherium*, had the canines longer than the other teeth, and developed into sharp-pointed weapons; necessitating a break in the dental series to receive their summits in closing the mouth.

The *Anoplotherium* had 19 vertebræ between the neck and sacrum, viz. 13 dorsal and 6 lumbar. The *Palæotherium* had 16 dorsal and 7 lumbar vertebræ.

The *Anoplotherium* had a femur with two trochanters, and the fore-part of the ankle-bone, called "astragalus," divided into two equal facets. Its hoofs formed a symmetrical pair on each foot. Cuvier has very justly inferred that its stomach must have been complex, and probably, in some respects, like that of the Camel or Peccari. The *Palæotherium* had a femur with three trochanters, an astragalus with its fore-part unequally divided, and hoofs, three in number, on each foot. It most probably had a simple stomach, like the Tapir and Rhinoceros, which, amongst existing animals, most nearly resemble that extinct primitive hoofed quadruped, with toes in uneven number.

Every species of ungulate mammal with an uneven number of hoofs or toes, that has been introduced into this planet since the eocene tertiary period, whether it have 1 hoof on each foot, as in the Horse, 3 as in the Rhinoceros, or 5 as in the Elephant, resembles the *Palæotherium* in having more than 19 dorso-lumbar vertebræ, which vertebræ also differ in number in different genera; e. g. 22 in the Rhinoceros, 23 in the Mastodon, 27 in the Hyrax. The typical Pachyderms, with an odd number of hoofs, have also three trochanters on the femur, the fore-part of the astragalus unequally divided, and the pattern of the grinding surface of the molar teeth unsymmetrical, and usually crossed by oblique enamel-ridges. All the existing odd-toed or perissodactyle mammals have a simple stomach and a vast and complex cæcum; the horned species have either a single horn, or two odd horns, one behind the other on the middle line of the head, as e. g. in the one-horned and two-horned Rhinoceroses.

Every species of ungulate animal with hoofs in even number, whether 2 on each foot, as in the Giraffe and Camel, or 4 on each foot, as in the Hippopotamus, resembles the *Anoplotherium* in having 19 dorso-lumbar vertebræ, neither more nor less; in having two

trochanters on the femur, in having the fore-part of the astragalus equally divided, and in having the pattern of the grinding surface of the molar teeth more or less symmetrical. The horned species have the horns in one pair, or two pairs. All have the stomach more or less complex, and the cæcum small and simple. In the Hog the gastric complexity is least displayed; but in the Peccari the stomach has three compartments; and in the Hippopotamus it is still more complex. But the most complex and peculiar form of stomach is that which enables the animal to "chew the cud," or submit the aliment to a second mastication, characteristic of the large group of even-hoofed *Ungulata*, called "*Ruminantia*."

These timid quadrupeds have many natural enemies; and if they had been compelled to submit each mouthful of grass to the full extent of mastication which its digestion requires, before it was swallowed, the grazing ruminant would have been exposed a long time in the open prairie or savannah, before it had filled its stomach. Its chances of escaping a carnivorous enemy would have been in a like degree diminished. But by the peculiar structure of the ruminating stomach, the grass can be swallowed as quickly as it is cropped, and be stowed away in a large accessory receptacle, called the "rumen," or first cavity of the stomach; and this bag being filled, the ruminant can retreat to the covert, and lie down in a safe hiding-place to remasticate its food at leisure.

The modifications of the dentition, œsophagus, and stomach, by which the digestion in the *Ruminantia* is carried out, were described and illustrated by diagrams.

The speaker next treated of the various kinds of horns and antlers; the manner of growth, shedding, renewal, and annual modifications of the deciduous horns, the peculiarities of the persistent horns, the mechanism of the cloven foot, and the provision for maintaining the hoofs in a healthy condition, were pointed out.

The following were the chief varieties of the ruminating stomach. In the small Musk-deer (*Tragulus*) there are three cavities, with a small intercommunication-canal between the second and last cavity; the "psalterium," or third cavity, in the normal ruminating stomach, being absent. This cavity is likewise absent in the Camel-tribe, which have the cells of the second cavity greatly enlarged, and have also accessory groups of similar cells developed from the rumen, or first cavity. These cells can contain several gallons of water. The relation of this modification, and of the hump or humps on the back, to the peculiar geographical position of the Camel-tribe, was pointed out.

The modifications of the ruminating stomach; the discovery of rudimentary teeth in the embryo *Ruminantia*, which teeth (upper incisors and canines) have been supposed to characterize the Pachyderms; the occurrence of another alleged pachydermal character, viz. the divided metacarpus and metatarsus, in the fœtus or young of all ruminants, and its persistence in the existing *Moschus aquaticus*, and in a fossil species of Antelope; the absence of cotyledons in the chorion of the Camel-tribe, with the retention of some incisors as well as canines in the upper jaw of that tribe; the ascertained amount of visceral and osteological conformity of the supposed circumscribed order

Ruminantia, with the other artiodactyle (even-toed) Ungulata ; above all, the number of lost links in that interesting chain which have now been restored from the ruins of former habitable surfaces of the earth—all these and other similar facts have concurred in establishing different views of the nature and value of the Ruminant order from those entertained by Cuvier, and the majority of systematic naturalists up to 1840. Thus instead of viewing the *Anoplotherium* as a pachyderm, the speaker, having regard to the small size of its upper incisors and canines, to the retention of the individuality of its two chief metacarpal and metatarsal bones, and to the non-development of horns at any period of life, would regard it rather as resembling an overgrown embryo-ruminant—of a ruminant in which growth had proceeded with arrest of development. The ordinal characters of the *Anoplotherium* are those of the *Artiodactyla*. On the other hand, instead of viewing the Horse as being next of kin to the Camel, or as making the transition from the Pachyderms to the Ruminants, the speaker had been led, by considerations of its third trochanter, its astragalus, its simple stomach and enormous sacculated cæcum, the palæotherian type of the grinding surface of the molars, and the excessive number of the dorso-lumbar vertebræ, to the conviction of the essential affinities of the *Equidæ* with other perissodactyles (odd-toed hoofed beasts).

The primitive types of both odd-toed and even-toed Ungulates occur in the eocene tertiary deposits: the earliest forms of the ruminant modification of the *Artiodactyla* appear in the miocene strata. The fossil remains of the aboriginal cattle of Britain have been found in the newer pliocene strata, in drift-gravels, in brick-earth deposits, and in bone-caves. Two of these ancient cattle (*Bovidæ*) were of gigantic size, with immense horns; one was a true Bison (*Bison priscus*), the other a true Ox (*Bos primigenius*); contemporary with these were a smaller species of short-horned Ox (*Bos longifrons*), and a Buffalo, apparently identical in species with the Arctic Musk-buffalo (*Bubalus*, or *Ovibos, moschatus*).

The small Ox (*Bos longifrons*) is that which the aboriginal natives of Britain would be most likely to succeed in taming. They possessed domesticated cattle (*pecora*) when Cæsar invaded Britain. The cattle of the mountain fastnesses to which the Celtic population retreated before the Romans, viz. the Welsh “runt” and Highland “kyloe,” most resemble in size and cranial characters the pleistocene *Bos longifrons*. Prof. Owen therefore regards the *Bos longifrons*, and not the gigantic *Bos primigenius*, as the source of part of our domestic cattle.

From the analogy of colonists of the present day he proceeded to argue that the Romans would import their own tamed cattle to their colonial settlements in Britain. The domesticated cattle of the Romans, Greeks, and Egyptians bore the nearest affinity to the Brahminy variety of cattle in India. As the domestic cattle imported by the Spaniards into South America have, in many localities, reverted to a wild state, so the speaker believed that the half-wild races of white cattle in Chillingham Park, and a few other preserves in Britain, were descended from introduced domesticated cattle. The size of the dew-

lap, and an occasional rudiment of the hump in these white cattle, as well as the approximation to the light-grey colour characteristic of the Brahminy race, seemed to point to their primitive oriental source. But the speaker could not regard the pure white colour as natural to a primitive wild stock of oxen. It is now maintained by the careful destruction of all piebald calves that are produced by the so-preserved half-wild breeds.

If the blood of any of the aboriginal cattle, contemporary with the Mammoth and hairy Rhinoceros, still flowed in the veins of any of our domesticated races, he thought it would be that of the *Bos longifrons* transmitted through the short-horned or hornless varieties of the oxen of the mountains of Wales and Scotland.

In conclusion the speaker referred to the subjoined table of the classification of recent and extinct hoofed quadrupeds, as indicative of the progressive extinction of those forms of *Ungulata* least likely to be of use to man, and of the substitution of the ruminant forms, which, from the perfect digestion of their food, elaborate from it the most sapid and nutritious kinds of flesh.

UNGULATA.

Typica.

Aberrantia.

ARTIODACTYLA*.	PERISSODACTYLA †.	TOXODONTIA.	SIRENIA.
Anoplotherium.	Palæotherium.	Toxodon.	<i>Manatus.</i>
Chalicotherium.	Paloplotherium.	Nesodon.	<i>Halicore.</i>
Dichobune.	Lophiodon.		<i>Rytina.</i>
Cainotherium.	Coryphodon.	PROBOSCIDA.	Halitherium.
Poebrotherium.	<i>Tapirus</i> ‡.	<i>Elephas.</i>	Prorastomus.
Xiphodon.	Macrauchenia.	Mastodon.	
<i>Moschus</i> †.	Hippotherium.	Dinotherium.	
<i>Antelope.</i>	<i>Equus.</i>		
<i>Ovis.</i>	Elasmotherium.		
<i>Bos.</i>	<i>Hyrax.</i>		
<i>Cervus.</i>	<i>Rhinoceros.</i>		
<i>Camelopardalis.</i>	Acerotherium.		
<i>Camelus.</i>			
<i>Auchenia.</i>			
Merycotherium.			
Merycopotamus.			
<i>Hippopotamus.</i>			
Dichodon.			
Hyracotherium.			
Hyopotamus.			
Anthracotherium.			
Hippohyus.			
Chæropotamus.			
<i>Dicotyles.</i>			
<i>Phacochærus.</i>			
<i>Sus.</i>			

* Ἄρτιος, παρ ; δάκτυλος, digitus.

† Περισσοδάκτυλος, qui digitos habet impares numero.

‡ Only those genera printed in italics now exist.